JPRS 68490

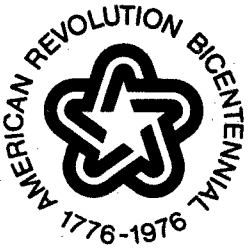
17 January 1977

WORLD

WIDE

TRANSLATIONS ON ENVIRONMENTAL QUALITY

No. 128



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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 68490	2.	3. Recipient's Accession No.
4. Title and Subtitle TRANSLATIONS ON ENVIRONMENTAL QUALITY, NO. 128			5. Report Date 17 January 1977 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstracts

The serial report contains translations from the world press of articles and press commentary on environmental pollution and its effects and pollution control technology, organizations, and programs.

17. Key Words and Document Analysis. 17a. Descriptors

Worldwide
Pollution
Environmental Control
Meteorology
Ecology

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group 4, 6, 18G, 18H

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Unlimited Availability Sold by NTIS Springfield, Virginia 22151	UNCLASSIFIED	38
	20. Security Class (This Page) UNCLASSIFIED	22. Price

JPRS 68490

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TRANSLATIONS ON ENVIRONMENTAL QUALITY

No. 128

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CONTENTS (Continued) Page

WESTERN EUROPE

BULGARIA

WATER PURIFICATION SYSTEMS AT ATOMIC POWERPLANT DESCRIBED

Sofia ENERGETIKA in Bulgarian Nos 8-9, 1976 pp 38-43

[Article by Engr Lazar Saev and Engr Angel Radulov, Kozloduy Atomic Powerplant: "Systems for the Special Water Purification at the Reactor Shop of the Kozloduy Atomic Powerplant"]

[Text] The implementation of the general line of the BCP for the development of a nuclear power industry in Bulgaria began with the construction and commissioning of the first and second blocks of the Kozloduy AETs [Atomic Powerplant]. We know that this is a standard powerplant with VVER-440 reactors.

The basic difference between atomic and thermal powerplants is the existence of a special area which contains the power reactor systems. Since the Kozloduy AETs reactor type is of the water-water variety, the type of technological system used for the accumulation and processing of the water of this zone is particularly important.

The industrial waters in the reactor shop (RTs) may be classified on the basis of several criteria. Thus, for example, in terms of the value of their sum total activeness based on dry residue they may be the following:

Highly active -- $\leq 10^{-4}$ Ci/1. We may add to these waters the waters of the core selection containers of the first circuit, the organized drainage from the stuffing boxes of the big armature, the flushing waters of the filters of the SVO-1 [water purification system] and SVO-4, the reactor drainage waters, the waters of the basins for recharging and keeping of used casettes, and others;

Low activity -- $<10^{-4}$ Ci/1. They include the waters of the special washer, the unorganized draining of the stuffing boxes, waters from the pipelines, the industrial waters from the operations of the SVO-3 and SVO-5 filters, the waters of the deactivation of equipment and furnaces, and others.

In terms of physical and chemical composition the RTs waters may be the following:

Sewage -- waters with a high content of salts and mechanical and organic admixtures;

Polluted condensate -- waters with a low salt content but high boric acid concentration (5-8 grams/liter), practically with no mechanical pollution;

Pure condensate -- desalinized water from the KhVO [expansion unknown] or processed water containing indicators close to those of desalinized water.

The methods for the processing of the water in the RTs may be several. In practical terms, however, two have been used: distillation and ion exchange. Each of these methods has its advantages and shortcomings. However, the problems have been resolved accurately with the technological system selected by the designer for the Kozloduy AETs.

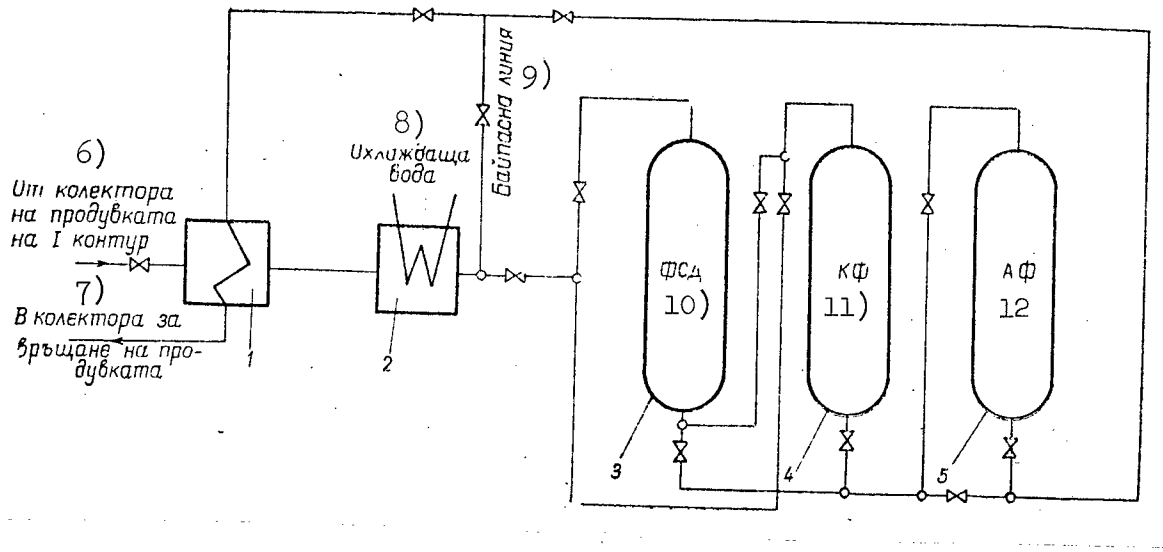

Figure 1. SVO-1 Basic Technological System

Key:

1. regenerative heat exchange
2. additional cooler
3. mixed action filter
4. cationite filter
5. anionite filter
6. from the collector of the first scavenge cycle
7. to the scavenge return collector
8. cooling water
9. bypass line
10. FSZ
11. KF
12. AF

The individual systems of the SVO at the Kozloduy AETs are the following:

I. System for Purification of the First Circuit Coolant -- SVO-1

The purpose of the system is to remove the basic pollution of the first circuit coolant. They include:

a. Product of the corrosion of the structural materials of which the circuit itself is made;

b. Fission products which have fallen in the circuit as a result of leaks of coolant elements (TOE);

c. Admixtures which have penetrated the circuit with the additional water.

This pollution may be a dispersed or ionic condition. Its purification takes place through ion exchange filters working under pressure equalling that of the first circuit. Since operational temperatures must be consistent with the thermal stability of ion exchange resins, the system works in harmony with the coolants which lower the scavenging water temperature to 40° with a temperature blocking which becomes engaged at a temperature in excess of 60°. The filtering part is bypassed and the coolant is returned directly to the first circuit.

The SVO-1 has three filters: cationite, mixed action filter (FSD), and anionite. They are charged with Wolfatite and Soviet produced resins.

The cationite filter is in an N-work form with a 1 cubic meter charge. The anionite filter is in an ON-work form with a 1 cubic meter charge. The mixed action filter is charged with cationite in a potassium-ammonium form and anionite in a borate form in a proper ratio with an overall volume of 1-1.2 cubic meters.

The system's productivity is 20 cubic meters per hour.

II. SVO-2 First Cycle Sewage Water Purification System

This is an auxiliary system which treats the first cycle drainage waters and, eventually, waters from the basins for recharging and storing of used nuclear fuel.

Since by virtue of quality and composition such waters resemble those of the first cycle, following their SVO-2 treatment they are stored and dumped directly into the first cycle. Here again the ion exchange method is used for treatment purposes.

The system has receptacles in which drainage waters collect, pumps taking the waters to the filters, filters, and reservoirs from which the waters are supplied to the first cycle feeding collector or, in the case of imbalance, to the evaporation part of the SVO-3.

The filters work at a 0.4-0.8 MPa pressure (4-8 atmospheres) and are charged with Wolfatite ion exchange resins in the following sequence:

1 KF with cationite 1 cubic meter in potassium or potassium-ammonium form;

2 KF with cationite 1 cubic meter in N-working form;

AF with anionite 1 cubic meter in an ON-work form, converting in the treatment process into a borate form.

The system has a 20-40 cubic meters per hour productivity depending on technological requirements.

III. SVO-3 System for the Treatment of Waters from the Installation Deactivation, the Waters from the Technological Operations Along the Filters, and the Special Sewer Waters

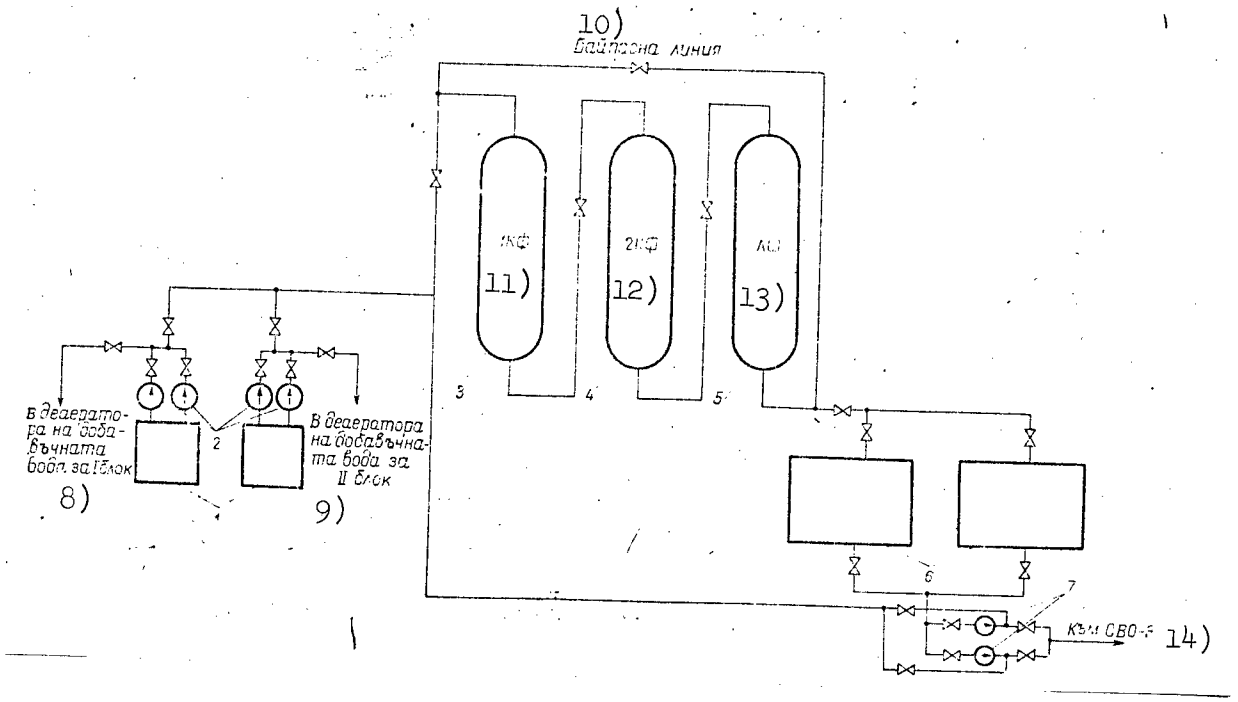

Figure 2. Basic SVO-2 Technological System

Key:

1. Organized first and second block leakage receptors
2. leakage pumps
3. K-type cationite filter
4. N-type cationite filter
5. anionite filter
6. "polluted" condensate reservoirs
7. "polluted" condensate pumps
8. to the deaerator of the additional water for block 1
9. to the deaerator of the additional water for block 2
10. bypass line 3
11. 1KF
12. 2KF
13. AF
14. to SVO

The purpose of the system is to process low active waters with mechanical pollution and high salt content. Such waters contain salts, including boric acid, up to 10 grams/liter or an average of 5 grams/liter. In this case the use of the ion exchange method is inexpedient, for it would require a rather frequent filter regeneration, an increased amount of flushing waters, and frequent replacement of ion exchange resins due to loss of operating exchange capacity (ROS). That is why the treatment of the SVO-3 waters is accomplished in two stages: the first is the distillation treatment in which the essential admixtures of radioactive pollution are essentially removed; the second is the ion exchange further treatment until an activeness of 10^{-9} Ci/l is reached with a view to the reutilization of the treated water within the plant's technological cycle.

The waters in the system enter the block receptacles from where they are pumped into the basic reservoirs (3); from there, with the help of other pumps, they are fed to the evaporation apparatus.

The evaporation appratus itself is heat exchanger with a forward heating container and separator. Steam under 0.35 MPa (3.5 atmosphere) pressure is used to heat up the treated solution. The secondary steam formed in the evaporation of the solution goes into the separator where it is cleaned from water drops passing through Raschig rings and other separating systems, after which it is fed to the condenser-degassifier. Here the steam is condensed and the solution is degassified. The separated gases go into the technological blower system (areas where technological gases are accumulated), for further treatment and emission into the atmosphere. The steam is condensed with cooling water from the main industrial water collector.

From the evaporation apparatus, the condensate or the so-called deaerated water, goes through a distillate cooler which lowers the temperature to below 50° and is pumpted, depending on integrators, to the ion exchange part for further treatment or directly to the control reservoirs for further utilization within the technological cycle.

The SVO-3 has five filters: one mechanical, common for the two similar SVO-3 systems and two pairs -- cationite and anionite. They are charged with ion exchange Wolfatite resins -- nuclear class -- as follows:

Cationite filters with strongly acid cationite in N-operation form;

Anionite filters with strongly alkali anionite in ON-operation form.

The amount of resins in the filters are 1 cubic meter each.

The technological systems call for the possible regeneration of KF and AF, respectively with 5-8 percent nitric acid or sodium base solutions. Filters are regenerated and flushed with direct current.

IV. SVO-4 Water Purification System from the Basins for the Recharging of the Nuclear Fuel and Storing Processed Fuel Casettes

Since the operation of the transportation of fuel to and from the reactor takes place under water it is technologically necessary to maintain specific indicators. The plan calls for filling the basins for reloading and storage with water, consistent with the first cycle norms.

Due to the characteristics of the preloading system there may be a time at which the water indicators deviate from the norms. This requires their treatment carried out by the SVO-4 system.

The system consists of a mechanical and two ionite filters. The mechanical filter has a 5 cubic meter filtering material operational volume and is charged with activized BAU charcoal. The cationite and anionite filters are charged with Wolfatite resins in N and ON-forms respectively.

The regeneration lines lead to the SVO-4 ionite filters.

The system has a productivity of 40 cubic meters per hour.

V. SVO-5 Steam Generator Blower Purification System, Second Cycle

The proper observance of the second cycle technological system and the maintenance of the water system within the limits of planned and operational norms call for the blowing of the second cycle steam generators. This is the purpose of the SVO-5.

The steam generators are continuously blown. They may be blown periodically as well depending on the need for and quality of the blown water. From the blower collectors the steam generator water flows through a throttling system into a blower expansion where, through a heat exchange and constant outlay control system it enters the filtering area for treatment. With a continuing blowing the system handles up to 18 cubic meters per hour; in periodical blowing it handles up to 35 cubic meters per hour.

The SVO-5 filter section consists of two equivalent triple filters: mechanical, cationite and anionite. The mechanical filters are each charged with 1 cubic meter activized BAU charcoal. The cationite and anionite filters are charged with strong acid cationite and strong alkali anionite in their N and ON-working forms.

The regeneration lines with nitric acid and potassium base lead to the SVO-5 filters.

The blowing water of the steam generators is not radioactive under normal operations. It is possible, however, that leakages may arise in the course of the operations in the collectors and pipes of the steam generator causing the appearance of radioactiveness in the blowing water. This is the purpose

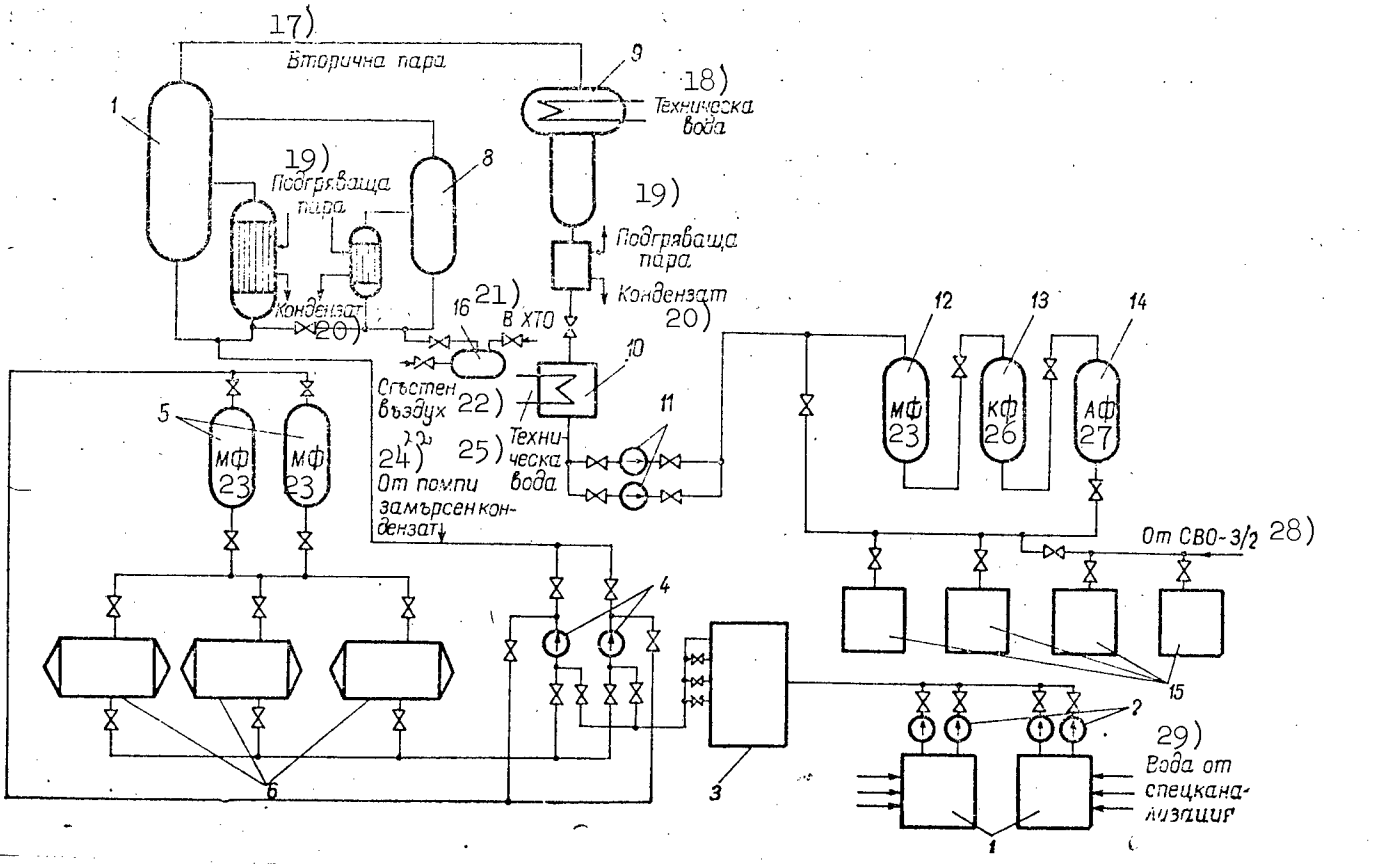

Figure 3. Basic SVO-3 Technological System

Key:

1. Sewage water receptacles
2. Sewage water pumps
3. Holding container [prestoynik]
4. Sewage water pumps
5. Mechanical filters
6. Sewage water reservoirs
7. Evaporator
8. Further evaporator
9. Condenser-degassifier
10. Distillate cooler
11. Distillate pumps
12. Mechanical filter
13. Cationite filter
14. Anionite filter
15. Control reservoir
16. Automatic displacement elevator for tube residue
17. Secondary steam
18. Industrial water
19. Heating steam
20. Condenser
21. to KhTO
22. Compressed air
23. MF
24. Polluted condensate from pumps
25. Industrial water
26. KF
27. AF
28. from SVO-3/2
29. Water from special sewer

of the constant radiometric control after the blower expansion. Any radioactive pollution is eliminated in the filtering section and the waters are returned to the technological second cycle.

The tuning and operation of all parts of the technological system were carried out successfully thanks to the active assistance of Soviet specialists Konstantinov, Rovnov, Morozov, Kargalov, and Krasikov who earned deservedly the recognition and respect of the entire shop collective.

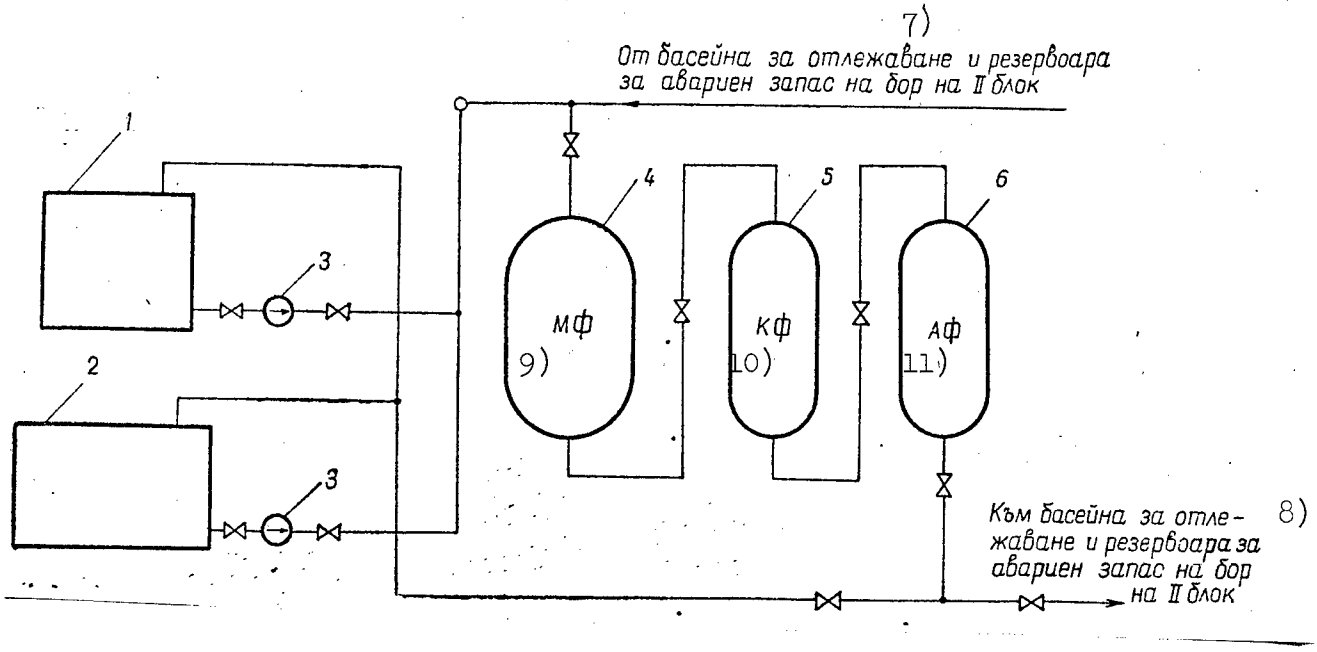

Figure 4. Basic SVO-4 Technological System

Key:

1. Casette storage basin
2. Emergency boron reservoir
3. Pumps
4. Mechanical filter
5. Cationite filter
6. Anionite filter
7. From the storage basin and boron emergency supply reservoir of the second block
8. to the storage basin and boron emergency reserve reservoir of the second block
9. MF
10. KF
11. AF

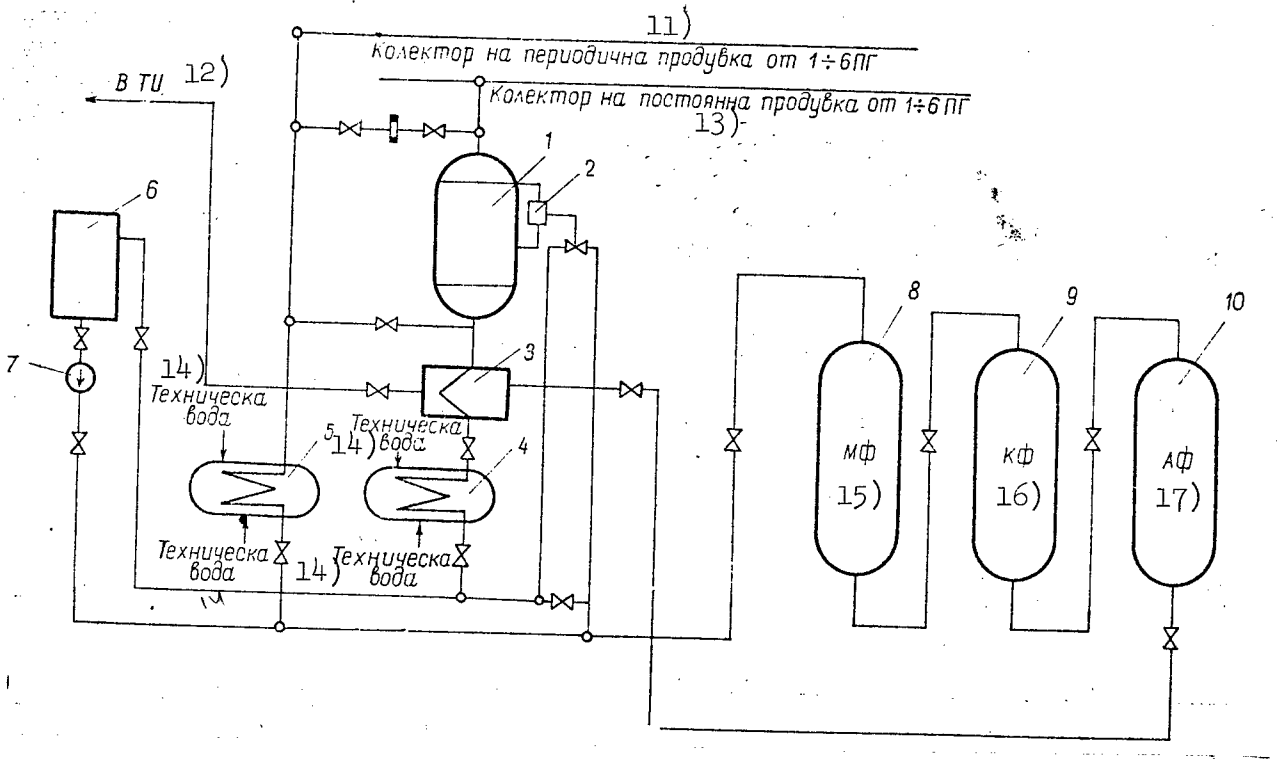

Figure 5. Basic SVO-5 Technological System

Key:

1. Blower expansion
2. Level control
3. Regenerative heat exchanger
4. Blower cooler
5. Periodical blower cooler
6. Overflow container
7. Pump
8. Mechanical filter
9. Cationite filter
10. Anionite filter
11. Periodical blowing collector 1:6PG
12. to the TU
13. Permanent blower collector 1:6PG
14. Industrial water
15. MF
16. KF
17. AF

5003
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SAVINJA RIVER POLLUTION CAUSES CONCERN

Maribor 7D in Slovenian 14 Oct 76 pp 16-17

[Article by Dragica Mordej]

[Text] The Savinja River is poisoned to such an extent that it represents danger to human life and threatens the continued existence of the health spa at Lasko.

Two years ago all life in the Sava River between Medvode and Moste was completely destroyed.

For the second time in the recent past tons of dead fish were washed ashore by the Drava River.

Zbiljsko Jezero [Zbiljsko Lake] had to be stocked with a half ton of trout the cost of which was paid by money contributed by the fishermen themselves.

The Reka River is dead below Ilirska Bistrica and seriously interferes with the scenic beauty of Skocjanske Jame [Skocjan Caves]. People flee from its shores and the caves smell with its stench.

The fish of the Paka River, too, have turned up their bellies on several occasions. Neither did the poisonous effluents spare the Sora River, nor Mirna River, nor Kamniska Bistrica River. In fact, it would be easier to say which of the Slovenian rivers has so far escaped pollution. The Soca River, perhaps? Not at all. Its lower part also had to feel the poison spread by man through the environment, the very same natural environment that nourishes him. Who are the culprits? Why are they not punished so they would no longer find it convenient to plug their ears and ignore the dying life outside? Shall we eventually become resigned to the thought that the sparkling streams which once used to flow through our country have been replaced by poisonous rivers? In the last 13 years 606 major poisonings of our river were recorded. The damage amounted to more than 11 million dinars. We must pause and think about this.

An Articulate Conversation

Before I went to visit Skocjanske Jame to inspect in addition to their scenic beauty their present state, I happened to hear in a village inn a heated argument between two local residents who were expostulating on their views regarding the future of the Reka River and its subterranean caves. "The Reka River will never again be as clear as it once used to be. Go ahead and print what I said. I used to drink it as water from a spring, but now I would croak if I only smelled a whiff of it," said the older of the two, as he pounded the table. "Oh, don't try to be so dramatic," the other one tried to smooth things out. "It is already better now than it used to be a few weeks ago." "You call this better? Any soup will thin out if you pour in water, no wonder Reka River did, too, after the steady downpours of the last week." Seething with anger the native turned toward me. That was the way the things were, he said, and it is always so when we attempt to solve a crucial problem. That "dude" at the other end of the table was simply a typical representative of the mass apathy who could not be disturbed by the dying river and who would do only what is absolutely necessary to satisfy the requirements of the law and regulations. The "dude" was apparently used to such recriminations and, taking no offense, tried to steer the conversation to better days supposedly in store for the Skocjanske Jame. But the older man, a powerful fellow, would not let him talk: "What modernization are you talking about? Who will want to visit our stinking grottos, I ask? The stench in there would make a skunk die!"

Grayness That One Can See in the Twilight

I shall not dwell on the scenic beauty of Skocjanske Jame, although it would be well worth mentioning in its own right. In the caves I hurried, whenever possible, ahead of the guide who led our group of tourists. I wanted to descend as soon as possible 170 meters below the surface to Sumeca Jama [Roaring Grotto] from where one could hear the sound of the river called simply Reka [=river]. The springs of this intermittent river [ponikalnica = river on a dolomite terrain that disappears in places underground and surfaces again downstream] are under the Sneznik Mountain where the stream is still pure and uncontaminated. To Skocjanske Jame, however, it brings the poisonous smell of a dead river. I stood on the bridge and watched the torrential flow of the river falling over the rocks with a thundering sound. At small river inlets the water hurled itself between the rocks carrying with it dirty grayish-white foam. It was collecting in filthy bands on the rocky shore, stretching and twisting in dirty rolled-up forms. The scene made me recall the beaches of Split, although in Split one distinctly feels a repulsive smell. Here, however, I felt nothing except moist and stagnant atmosphere. "These days the Reka River is already somewhat cleaner, but last week it looked like milk and the smell could no longer be ignored. To the tourists we carefully and patiently explained what was the matter. Naturally we added that that smell was a rare phenomenon, that the river was polluted, and that the water purifying installations are being readied for application. We are ashamed of being so

childishly irresponsible as to allow the pollution of a grotto which foreign tourists who sometimes will travel over 10,000 kilometers to come here find well worth visiting." In these words the tourist guide Anton Ivancic warranted the sad story of the Reka River. He was trying to sound dispassionate, refraining from expressing sentiments of a native who grew up near the river. "The pollution of this river is nothing new. In 1965 the water level in Sumeca Jama rose full 86 meters because the refuse plugged up the river's draining syphon." I pointed out to Anton Ivancic that two organizations of associated labor in Ilirska Bistrica are endeavoring to clean up the river and to see that no further pollution takes place. "I give little credence to those promises for, after all, the pollution did not come overnight. The organic acids plant discharges poisons in it while the lumber mill contributes other pollutants. Even if they tried to clean the river up it would never be as limpid and clear as it used to be. No, I dare not dream that it will ever again be possible to water the livestock at this river, that wildlife will return, and that the river will come to life again. We have known for a long time that the Reka River problem is being 'solved,' but this is a very general statement and that is all it amounts to. We, the local residents, do not believe in this; there is nothing tangible to seize upon nor anything specific being said about taking care of the Reka River."

It Would Take Courage To Modernize the Caves

At one time only torches were used to light the caves; then it was discovered that carbide lamps were considerably less expensive. The wild roar of the Reka River commanded respect, for it could not be seen at all unless the guide threw in a lighted match. Later, electrical lighting was installed in the caves and the mysterious subterranean river lost some of its mystical aura. Soon afterward plans for modernizing the caves were prepared. However, those plans were not carried out and, according to all appearances, things will remain as they are for some time to come. Quite a few people would, upon taking a closer look at the plans, be something less than enthusiastic about the planned innovations, which will detract from the enchanting wilderness of the caves. "Our plan provides for removing the tourist from the caves," said Viktor Borjancic, director of commercial operations at the Kras Sezana hotel TOZD, summarizing the highlights of the project. "In the first place we wish to open up to the tourists a few other caves. The Videnica cave will be one of them. Skocjanska Jama is known to require a great deal of exertion on the part of the visitors. The length of the cave is 5.5 kilometers and the climb leading back to the surface at the other end could be even dangerous for older persons. Accordingly, our plan provides for an elevator at the exit, a restaurant, and restrooms--which is the minimum a visitor can expect in addition to the scenic attractions of the cave. Walking up and down over a distance of 6 kilometers and negotiating a long flight of stairs at the end is not at all pleasant for an older person. This is probably one of the reasons why we have no more than 30,000 visitors per year compared with 800,000 visitors of Postojnska Jama [Postojna Cave].

However, before the commitment is made to make all these investments, the problem of the Reka River pollution must first be resolved, otherwise it would make no sense to invest a single dinar toward modernizing the caves.

Reka River Is Only One Out of Many

In most instances of river pollution the opstina and republic authorities took action on their own. Why are all these actions to correct and prevent pollution of our rivers so ineffective? It has been established that the principal reason for the disaster is neglect of existing legislation and poor performance of authorities charged with its enforcement. In our zealous development of industry we have forgotten to provide for effective protection of the environment. Another reason is the high cost of filter installations for which there is no money. However, it soon became apparent that the root causes can all too often be traced to poor selection of technology, improper organization of work, to ignorance, that universal bane at the low cultural level of those to whom the collective delegated the responsibility for clean environment but who are unable to handle it, as well as to all those individuals who shamelessly pollute the environment by leaving their refuse wherever they go.

Fishermen's societies that developed and grew with our rivers, to whom clean rivers are of primary concern, are trying to obtain means for restoration of the poisoned rivers' fauna by bringing suits. And what is the outcome of these suits? The case of the Sava River, in which all life was extinguished 2 years ago, is well known. The damage amounted to at least 60,000 dinars. The Fishermen's League has filed a suit which has not been resolved to this date. The fishermen's community had to come up with more than 7,000 dinars so that fish could come back to the Sava River. In face of all this chaos the polluters cannot even point to lack of laws or claim that regulations are poorly drawn. We have laws and regulations, but who wants to observe them when they can be avoided by paying reasonably tolerable fines. Clever economists have calculated that payment of fines is more economical than investments in safer sewers or installations for filtering or neutralizing the effluents.

Most shocking in all this, however, is the fact that these people are not in the least troubled by their conscience nor are they disturbed by the thought that Slovenia, once famed for its beauty, will be left for their children devastated and desolate.

12070
CSO: 5000

AIR POLLUTION IN SLOVENIA CAUSES HEALTH PROBLEMS

Ljubljana ITD in Slovenian 12 Nov 76 p 5

[Article by Marjan Raztresen]

[Text] Medical doctors were traditionally counseling people to open their windows often so that their living quarters might have fresh air, which is of great importance for one's health.

This they used to do until last winter when one could, for the first time in the history of Slovenia, hear from the doctors: "City dwellers, if you want to have clean air in your quarters, keep your windows shut. Do not breathe deeply when going out for a walk, press a napkin to your mouth. Older people should not go out unless absolutely necessary, they should stay at home, in closed rooms where the air is clean."

Last winter the city dwellers in Slovenia were indeed keeping their windows shut and walked about the town with napkins pressed to their mouth while small children, the infirm, and old people stayed at home where a walk in the hall was healthier than a walk through the park in the city center, over which hovered a choking, polluted and poisoned atmosphere.

Fourfold Damage

This winter we are promised more of the same: as soon as winter sets in poisonous gases from factories, furnaces and automobiles will in the absence of a steady breeze again form a blanket over the valleys, they will spread over the country smothering life and destroying even the inanimate objects. Poisons will be deposited in the lungs and blood, penetrating the skin, threatening particularly people of weaker constitution some of whom will succumb to them as they did last winter.

However, no one will be able to show that poisons emanating from a specific factory will have killed a person. No medical doctor in the world has ever stated that in his judgment a person died due to inhalation of excessive quantities of sulphur dioxide, lead or carbon monoxide present in the urban atmosphere.

Nevertheless, poisons discharged from smokestacks and exhaust pipes to the atmosphere kill. They kill people, too. And not only in the faraway Japan or in the highly developed industrial centers of Europe but right here, too, in Slovenia.

People who have a serious illness of respiratory or vascular organs can die because of sudden increases in concentration of poisonous gases in the air, although they could otherwise still be alive.

However, no medical doctor in the world is willing to declare that a person died because of poisoned air: he died because of a vascular or respiratory disease.

There is no doubt that the polluted air we are breathing causes harm in at least four ways, namely: harm to nature, and property, and biological and psychological harm.

Before the thermoelectric plant in Zasavje built a high smokestack which funnels poisonous gases out of the basin the poisons, primarily sulphur compounds and particulates were poisoning the basin. The situation was particularly acute in a certain place where the poisons being deposited accumulated and destroyed the soil so that it could no longer support life. All foilage was burned up so that trees were left bare. Other vegetation, too, was destroyed. One of the natives whose family had, on their land, for ages held its own against the adversities of nature and mankind, could no longer endure. He accepted compensation for his farm and moved away where he may perhaps be able to breathe clean air.

Valleys of Death

Now a smokestack more than 300 meters high has been erected in Zasavje and the nearly sterilized soil which the owners had to abandon no longer receives such copious doses of poison from the air as before. In a few years the soil perhaps will have recovered enough to sustain life again.

For the next few years, however, it has been written off.

The quantity of sulphur that is now coming out of the much higher smokestack in Zasavje is no smaller than what used to come out of the former low one. There is as much sulphur as before, only now the winds above the basin can spread it over a much larger countryside.

Thus the concentrations of sulphur dioxide in the more distant surroundings are now greater than they used to be, although there are no sources of pollution nearby. The poisonous charge that a short time ago used to fall only on the area in the immediate vicinity is now spread over a wider area.

"Fresh air in Slovenia can still be found only in the mountains," says Dr Dusan Hrovat of the Republic Institute of Health Care in Ljubljana. "Of course, we can now no longer insist on clean air; we demand, however, air that does not interfere with normal life."

However, today in all too many places we no longer have even that kind of air. In winter the residents of Ljubljana are breathing air that is almost poisonous; Mezica is known as the death basin; air in the entire Zasavje, which is located inside of a basin, is polluted beyond any allowable limit on winter days; residents of Celje will soon have to walk on the streets equipped with gas masks; Kranj and Jesenice are polluted beyond the allowable limit; people in some districts of Maribor are breathing noxious air; in Crna and Mezica clean air is being displaced by noxious gases; over Idria hovers, especially on winter days, a cloud of polluted air; Medvode is from time to time poisoned beyond any allowable limit.

Harmful Combinations

This, of course, does not exhaust the list of places enveloped in winter by curtains of health-endangering gases. Many other settlements in Slovenia are also included on this long and black roll; air in nearly all industrial settlements in Slovenia is polluted to excess.

As the sulphur dioxide mixed with particulates poisoned the soil above Trbovlje, so does the mixture of particulates and carbon monoxide--possibly with the admixture of some other poisons--destroy the vegetation of the most threatened city districts. Residents of Ljubljana, for example, walking along Presernova Cesta [Preseren Street] and Resljeva Cesta [Ressel Street], the two heavily used thoroughfares, can observe a phenomenon which is well worth reflecting upon, namely, the trees lining the two streets are green for only 2 months in the year, whereupon the foilage turns brown, shrivels up and falls off.

If the poisoned environment can act upon and destroy plants, it undoubtedly also affects people, those who walk along these streets and, even to a greater extent, those who must live in those streets all the time.

However, man can often endure more than a machine and he adapts to much hardier life than many plants or animals--and so he grew accustomed to the poisonous air he must breathe. Daily he is adapting himself to increasingly greater concentrations and often he scarcely feels that he is inhaling poison.

A person from rural areas who only occasionally comes to town or an industrial center from his as-yet unpolluted region will immediately feel the poison in the air. It makes him cough and sneeze, irritates his eyes or causes headaches.

Physicians investigating the correlation between smoking and cancer found that considerably more people who succumb to this disease are city dwellers rather than rural residents. While the rural population is poisoning itself only with tobacco, the city dwellers are in addition being poisoned with polluted air. The effects of air polluted by particulates, sulphur dioxide, lead, mercury, cadmium and many other substances are not only cumulative but they increase exponentially.

Afflicted Children

So far it is still unknown what effect air containing various pollutants has on the human organism. All harmful effects on human health have not yet been studied in detail. Although physicians and other experts throughout the world are making every effort to get to the bottom of the problem, they have so far not been successful. The answer to the question as to what effects highly diluted poisonous compounds in the air exert on human beings has not yet been found. This is a situation similar to that of nuclear radiation: no one knows how many generations of descendants of those who survived the atom bomb explosions in Japan will suffer the consequences.

We are adapting ourselves to polluted air, to increasingly more polluted air. However, no one can tell how man will change because of this and how the health of the entire poisoned humanity will be afflicted, because no one wants to be a false prophet.

"Danger to health and danger to life are too different things," says Dr Dusan Hrovat. "No one has yet managed to prove that a person died because of polluted atmosphere. To die because of this, one would have to inhale a poison gas used in chemical warfare. On the other hand, the lives of infirm persons and patients suffering, for example, from bronchitis, could be endangered were they to be suddenly exposed to air polluted by chemicals and particulates."

It is not at all surprising that man, who is a living being, succumbs under such adverse circumstances. Because of this very same air, cultural monuments that have weathered for centuries are decaying. Air such as people in Slovenia breathe in some places is causing decay of tile on the roofs and the brick in the walls where it is not covered or protected by plaster.

Is there, then, any wonder if poisons in the air that cause decay of the "external" rock can destroy the fragile human frame?

Dr Hrovat pointed out the psychological damage caused by the poisoned air. Although we are not now sufficiently aware of it, its consequences may be enormous when we realize what its true impact is. We are like men condemned to hanged, waiting only for the trap door under the gallows to give way. Although we may perhaps be spared, many will have died of fear when they feel the breeze on their neck and think that the noose has closed.

Of primary importance, said Dr Dusan Hrovat, is the fact that the entire population is exposed for an indefinite time or perhaps even permanently to bad, polluted, and almost toxic air, with concentration of poisons that may not be extremely high or excessive but which are permanent.

Some time ago the pediatrician docent Dr Zdenka Humar told us that in Ljubljana the number of children with respiratory ailments is increasing. While, like her colleagues elsewhere, she cannot prove that this is a consequence of polluted air, such inference is possible if one compares the percentage of afflicted children in cities with that of the rural areas. For this reason she suggests to parents of both afflicted and healthy children, and to themselves as well, that they use their free time, especially on Saturdays and Sundays, for walks in the countryside that has not yet been covered by the shroud which hovers over almost every larger settlement in Slovenia.

The Strictures of the Law

Air in Slovenia is protected by society. The matters concerning protection of the air are of particular importance to society. This is given special emphasis in the legislation on protection of the air which has been in effect in Slovenia since the beginning of last year.

If all the provisions of this law were enforced, the Slovenians would breathe much cleaner air than we do now, and quite a few persons would by now have paid stiff fines or even gone to prison because of having violated the provisions of this law.

Thus, for instance, the law provides that "Organizations of associated labor as well as other legal persons and individuals must operate and maintain buildings, plants and installations in a manner which does not cause concentrations of noxious substances that may be discharged into the atmosphere to exceed the limits prescribed by regulation."

Furthermore: "Organizations of associated labor and other legal persons whose buildings, plants or installations are discharging into the atmosphere noxious substances in excess of the allowed limit must make appropriate alterations on their buildings, plants or installations to comply with the air-pollution control program."

The penal provisions which provide for fines of up to 50,000 dinars (new dinars, of course) and up to 5 years of imprisonment state among other things: Any person in responsible charge of an organization of associated labor who in constructing a building, or installation, in contravention with the provisions of this law or regulations promulgated thereunder or through inadequate supervision of the operation of protective equipment or lack thereof, causes pollution of the air in excess of the allowed limit, to a greater extent or over a larger area and thereby endangers life or health of other persons, fauna or flora shall be punished by imprisonment."

Because this provision of the law has never been applied in practice, although it has been on the books for over a year and a half, the appropriate authorities simply forget to establish air-pollution control districts. Such districts have only recently been established in the most threatened regions of Slovenia but, according to the president of the federal Air Pollution Control Commission Dr Peter Novak of Ljubljana, no such districts have yet been set up in Ljubljana or Novo Mesto.

Disrupted Equilibrium

In the recent time more thought has been given to that which we do not have enough of in cities: namely, clean air. Professional engineer Urbanc, independent counselor on air quality at the Republic Committee on Environmental Protection, maintains that this year air in the cities and industrial centers of Slovenia did not deteriorate further in comparison with last year, although he cannot say that there has been an improvement.

Slovenia is now at a point where London and many places in Japan used to be some 10 years ago. After not a single fish was left in the Thames, and pedestrians in London were colliding with each other on winter days because they were unable to see through the sooty fog, the authorities sounded the alarm and took steps.

Now there are fish again in the Thames and the air on London is cleaner than ever before in this century. But the people had to go to great lengths before they succeeded in restoring the natural equilibrium that had been so seriously disrupted or destroyed.

In Slovenia, however, we are still releasing poisons in the atmosphere which we know we shall have to inhale ourselves.

12070
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ECONOMIC IMPACT OF 'WASTE-FREE' TECHNOLOGY DESCRIBED

Moscow EKONOMICHESKAYA GAZETA in Russian No 47, Nov 76 p 14

[Article by A. Tsygankov, Deputy Chief of the Environmental Protection and Natural Resources Use Department of the State Committee for Science and Technology: "Towards Waste-Free Technology"]

[Text] The widespread introduction of waste-free technologies in industrial branches is of tremendous economic, ecological and social importance, since it provides an opportunity for the utilization and reprocessing of production wastes which were previously sent to dumps or discharged into reservoirs or the atmosphere.

About 11 billion rubles of state funds are being allocated in this five-year plan to carry out a program of environmental protection and the efficient use of natural resources. Particular attention is being paid to the more active development of technological processes and systems which will be able to reduce the amount of waste and ensure its maximum utilization.

What is the current state of affairs in the solution of these problems? It is gratifying to note that definite successes have already been achieved. At the same time, certain branch leaders are not making the necessary efforts to organize the development and introduction at enterprises of their branches of new and progressive waste-free technologies and are not paying sufficient attention to the broad dissemination of existing highly efficient technologies.

In chemical industry, for example, the situation is fairly good, on the whole. Thanks to the installation of purification facilities at its enterprises the amount of water returned and reused is now about 80 percent. A sulfuric acid production process permitting a sharp reduction in the amount of harmful material discharged into the air basin has been introduced at the Sumskiy Chemical Plant and the Cherpovetskiy Chemical Plant. The increased capacity of units in ammonia and ammonium nitrate production has also reduced pollution. And there are other examples.

But the Belrus'kaliy and Uralkaliy enterprises are solving the problem of halite wastes very slowly. This is leading to the development of waste piles and to gradual salinization of the soil in this area, to increased mineralization and deteriorating hydrochemical conditions of the adjacent water basins.

Much work has been done in petroleum refining industry to further reduce harmful effects on the environment. However, the problem of utilizing the salts obtained as dry wastes or saturated solutions remains unsolved. True, the Lisichanskiy Petroleum Refinery has put into operation waste-free technology involving burying the salts or pumping them into deep beds, but this variant still cannot be considered optimum.

Extensive Reprocessing of Slags. In ferrous metallurgy, pig and steel production is inescapably connected with the production of large amounts of slags. The basic method of reprocessing them is granulation, with the resulting granulite being used in cement production. The large enterprises of the branch, such as the Azovstal', have special shops for reprocessing blast-furnace slag. Slag pumice, floated broken slag and mineral wool compounds are produced at a number of plants. But for full utilization and reprocessing of blast furnace slag, there must be extensive introduction of such installations as the one used at one of the blast furnaces of the Krivoy-Rog Metallurgical Plant, which permits recovery of all steam and gas wastes.

Steel-smelting slags can be used in certain types of metallurgical production, construction industry, road construction and agriculture. Unfortunately, currently only slightly more than 10 percent of them are reprocessed, which is, naturally, extremely inadequate for ferrous metallurgy.

The problem of removing iron from discarded products before they are used as raw material for building materials urgently requires solution. In this regard, the experience of the Olenegorskiy Ore Enrichment Combine merits dissemination. Technology for removing the iron from "tails" has been tested here. It has yielded an economic impact of about half a million rubles per year.

The basic methods of and the technical and economic substantiation for utilizing ferriferous bottoms and dust have been worked out for 18 large metallurgical enterprises. Introduction of this technology will enable them to obtain an additional seven and a half million tons, approximately, of ferriferous raw material with an average iron content of about 50 percent. Plans have already been worked out for production facilities to reprocess this raw material at the Krivoy-Rog, Dnepropetrovsk, Novo-Lipetsk and other plants. The practical implementation of these measures will improve natural resources use and will have a positive effect on the environment.

Nonferrous metallurgy is among those branches with the highest amounts of various wastes per unit of output, which is connected with the nature of the raw material used. In ore processing, the inert materials portion of the raw materials is all converted into solid and gaseous wastes.

Forecasts of world nonferrous metallurgy development offer no hope that the next 10-15 years will produce radical ways of getting rid of this large amount of waste.

At the same time, opportunities already exist for significantly reducing these wastes and using them more extensively. In domestic nonferrous metallurgy, pilot-plant tests have already been run on flow sheets for multipurpose reprocessing of wastes, and some of them are in widespread use at our enterprises -- the first practical applications anywhere in the world. For example, reprocessing alkaline aluminosilicate rock to produce alumina, soda and potash. The slurry obtained is used in cement production.

Multipurpose alunite ore reprocessing is being done. Waste-free aluminum and aluminum alloy production is ensured through the use of an electrothermal method. All the components of the initial raw material, with the exception of oxygen and sulfur, go into the aluminum-silicon alloy obtained. A shop using such technology is now operating at the Dneprovskiy Aluminum Plant. This experience merits our attention.

Waste-free lead-zinc raw material processing technology has now been developed. So far, it has been introduced at the Irtyshskiy Polymetallic Combine. Low-waste and waste-free nickle ore processing technologies are being developed and introduced. One such process will be introduced at the Noril'sk Mining and Metallurgical Combine.

All these are positive cases, but there are others which counterbalance them. In nonferrous metallurgy, for example, things are not going well in the utilization of slags from various production facilities. And the branch leaders of this industry must obviously pay more attention to solving this problem.

An Overall Approach Is Needed. Special attention should be focused on the role of building materials industry in the overall development of waste-free technology. Domestic and foreign practice testifies to the tremendous opportunities available for using much waste and many by-products as a valuable raw material and as additives in the production of cheap, high-quality building materials, items and structures. One example is cement industry, a major consumer of mineral raw material. It was one of the first to use industrial waste and the by-products of other branches successfully in large quantities.

The technology for producing ceramic slag, a valuable building material produced from slags as pressed sheets, laminated and shaped elements, and also as cast items, has been developed in this branch. The economic impact of using a single ton of ceramic slag is 60-160 rubles.

Thus, by consuming large amounts of solid wastes, the building materials industry is having a positive effect on environmental protection. It should be noted in this connection that branches and enterprises which produce a great deal of waste, such as nonferrous metallurgy, the coal and power industries and others, for example, do not always strive to reprocess wastes

in order to provide building materials industry with raw material and semi-finished products which are stable and homogeneous in terms of their physical-chemical and mechanical properties.

Briefly, about the machine-building ministries. At their enterprises, waste such as the shavings mentioned above is easily collected and is sent on to metallurgical plants as secondary raw material. However, the manufacture of machines and apparatus is accompanied by considerable water consumption, so the task is to eliminate operations which produce large amounts of waste water which is hard to clean.

As production grows in machine-building branches, used organic solvents accumulate. However, enterprise leaders have preferred not to conclude agreements with the USSR Ministry of Chemical Industry and Ministry of Petroleum Refining and Petrochemical Industry on developing special installations, but rather attempt to obtain "good" in other instances for burying or decontaminating particular wastes.

What is required to accelerate the introduction of waste-free technology in industrial branches?

In our view, it is necessary to work out new economic principles for developing and designing industrial production facilities which would take ecological problems into account. With this view in mind, the State Committee for Science and Technology and the USSR Academy of Science are taking steps to accelerate the development of methods of evaluating the economic impact of environmental protection measures with consideration of the introduction of various waste reprocessing systems. It seems to be time for our legislative organs to work out appropriate statutes on production waste use and detoxification problems.

The State Committee for Science and Technology, jointly with the ministries and departments, has become more active in improving and organizing work associated with solving the most important scientific and technical problems. Beginning this year, there has been a shift to coordination plans for goals programs. They include the most important scientific and technical tasks facing the national economy in the Tenth Five-Year Plan. The solution of a whole series of major interbranch problems on the development of new technological processes has been outlined. This will permit the fullest multipurpose use of natural resources being enlisted in the production sphere and a sharp reduction in the amount of waste polluting the environment.

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CSO: 5000

MOSCOW'S EFFORTS TO REDUCE TOXIC LEVELS OF AUTO EMISSIONS DESCRIBED

Moscow MOSKOVSKAYA PRAVDA in Russian 24 Nov 76 p 2

[Article by V. Chivilyev: "A Burning Question--Clean Auto Emissions"]

[Text] The task set forth by the party and the state for intensified efforts in natural protection and improvement in the condition of the environment is of especially great importance to major industrial and cultural centers of the country. First and foremost is Moscow. Its large population, numerous industrial enterprises, a developing transportation system and other factors must be taken into consideration whenever speaking about protection and the efficient use of nature's blessings.

With the aim of improving the condition of the air over our capital and lowering gas fume saturation, a number of enterprises are gradually withdrawing beyond the city limits, protective sanitary zones around plants and factories are being created, national parks are being developed and all sorts of sanitation treatment plants are being introduced. It is well known that Moscow no longer permits construction of new enterprises for heavy industry and for the chemical and machine building industries. All this has allowed for an almost 300 percent decrease in contamination of the city's air by fumes and dust over the last 10-15 years.

Alongside other measures, the most important is the work in lowering air pollution resulting from auto exhaust emissions and decreasing their harmful contaminants. Every one of our city's inhabitants sees year after year how our streets and highways are becoming more and more filled with cars and trucks and that the intensity of traffic is on the rise. This has to be telling on the level of air pollution. Therefore, a number of Moscow scientific research organizations have been entrusted to deal with the problems tied to decreasing the toxicity from motor transport.

First among these organizations are the Central Scientific Research Institute of Automobiles and Automobile Engines [NAMI], the State Scientific Research Institute of Automobile Transportation [NIIAT] and others. Hundreds of scientists, designers and engineers are actively participating in developing

economic, low-toxic engines and new types of fuel, and in improving repair and preventive maintenance while motor vehicles are serviced. This is greatly promoted by the contracts on scientific and technical cooperation concluded by them with the capital's industrial and operational automotive enterprises. And so, the cooperation between NAMI and the Motor Vehicle Plant imeni Likhachev and the transportation enterprises of Moscow has led to improved designs in the most important automotive assemblies and increased automotive longevity. This cooperation has developed the technology for accelerated reconditioning of worn parts and vehicle repair which, in the long run has resulted in lowering noxious exhaust fumes.

Many other examples of fruitful cooperative work between the capital's scientists and the collectives of enterprises of the automobile industry and transportation could be cited.

However, not all specialized scientific research organizations are devoting the necessary attention to resolving the problems of lowering transportation toxicity. Alas, as an example of an organization not being a worthy follower, I would like to mention the Scientific Research Toxic Engine Laboratory [NILTD].

This laboratory must not only itself conduct developmental work on lowering exhaust fume toxicity from internal combustion engines but must act as the coordinating scientific organization in this area. Unfortunately, the laboratory is far from fulfilling both these functions in the best manner.

An analysis of the thematic plans of NILTD at any rate arouses surprise. Research tied to the toxicity of gasoline engines comprises an insignificant portion of the work here. In recent years the laboratory has not presented an interdepartmental commission nor produced a single neutralizer for vehicles using gasoline engines although about a million rubles have been spent in the development of such devices.

Moscow has many motor vehicle transport enterprises available with practically unrestricted resources to carry out the final work on experimental models of devices to solve various technical problems. The automotive industry, as a rule, is ready to cooperate with scientific organizations and, in particular, with the NILTD. They have turned to the laboratory more than once with requests to conduct investigations tied to limiting the harm caused by spent gasoline. However, the managers at NILTD only rarely respond to these requests. For the years 1971-75 only six automotive transport organizations in Moscow received assistance from NILTD specialists in developing systems to regulate the operation of engines. And can one really speak seriously about such assistance if only four of the laboratory's collaborators are now employed?

The work plans of the scientific organizations suffer from serious shortcomings. This activity requires the coordination of NILTD. In a number of instances these plans were comprised without accounting for the general

trend of research. Work schedules are unjustifiably delayed and putting them into practice is a slow process.

Nothing is interfering with the collectives of NILTD and other scientific institutions in significantly increasing their contribution to improve protection of the capital's air and water basins. On the contrary, they have the means to accomplish this. It is important to realize the seriousness of this problem and to understand that with the increasing use of motor vehicles the development and introduction of processes aimed at reducing engine toxicity is becoming a problem of paramount importance to our city.

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CSO: 5000

RE-USE OF COMMERCIAL PACKAGING ADVOCATED

Moscow EKONOMICHESKAYA GAZETA in Russian No 49, Dec 76 p 17

/Article by V. Vorob'yeva, Chamber of Commerce specialist, and A. Vorob'yev, Candidate of Technical Sciences: "Waste-Free Technology in Business"/

/Text/ There has been no small number of fruitful developments in the field of waste-free technology in various branches of industry. In nonferrous metallurgy, for example, new techniques for reprocessing copper and polymetallic ores assure complete utilization of raw material while simultaneously reducing the harmful effect of waste products on the environment.

But is it possible to apply the principles of waste-free technology in the sphere of business? We anticipate the following responses: "What kind of wastes are there? What can this do for the national economy?."

As an example let us consider the use of the so-called glass containers which are completely recycled, much like water, in some industrial enterprises.

Tens of billions of glass bottles and jars are in circulation in our country each year. People return these containers to the commercial network. As a result, it is unnecessary for the state to manufacture billions of new bottles and jars each year. It has only to make up for natural losses.

The recycling of glass containers is a powerful economic lever. It is advantageous for both the state and the people. The following question suggests itself: why not adopt the deposit principle for other types of containers and packing in good condition? In order to provide seals for tens of billions of bottles and jars it is necessary to manufacture a corresponding number of crimped metal lids and plastic seals, which requires

the annual expenditure of many thousands of tons of plastic and steel, tinned and oxide plate. However, all this sealing and packing material is thrown onto the scrap heap after being used only once.

We do not neglect the observation that this is unavoidable, since part of the packing and sealing is destroyed, and it is impossible to recycle them in the economy. But packing material which is completely intact is destroyed and discarded. This is especially true of the packing on imported goods.

It appears that there is no unavoidable necessity completely to destroy packing material. What can be re-used should not be discarded, but rather should be put to use.

8963
CSO: 5000

BRIEFS

AIR POLLUTION CONTROL--From now on the air will be cleaner around the Ust'-Kamenogorsk Lead and Zinc Combine. The enterprise is now operating a unit for drying sulfur dioxide, which after purification becomes an ingredient in the production of sulfuric acid. Enterprise personnel have taken a number of other steps in the direction of sharply reducing the emission of harmful wastes into the atmosphere. The latest filters have been installed; a complex for the thorough purification of industrial and ventilation gases has been built; and more thorough processes in the production of nonferrous metals have been introduced in which harmful wastes are not produced. Similar measures have been carried out this year in many enterprises. An example of the results achieved is the significant increase in the degree of utilization of the sulfur contained in the raw material for melting lead, zinc and copper. The Balkhash and Dzhezkazgan mining and metallurgical combines in particular have sharply increased the production of sulfuric acid. The air in the vicinity of these large copper producers has become much cleaner. /Text/ /Moscow EKONOMICHESKAYA GAZETA in Russian No 49, Dec 76 p 17/ 8963

BIOLOGICAL PURIFICATION OF SEWAGE--Kuybyshev engineers have introduced the second stage of a biological sewage purification system into operation. Its capacity is 400,000 cubic meters per day. The introduction of the new complex and work on the reconstruction of the existing purification system have great significance for the national economy. Virtually pure water will now flow into the Volga. Work continues on urban purification facilities. /Text/ /Moscow EKONOMICHESKAYA GAZETA in Russian No 49, Dec 76 p 17/ 8963

DECONTAMINATING INDUSTRIAL WASTE -- At the Selenginskiy Pulp and Cardboard Combine, Buryatskaya ASSR, much attention is being paid to decontaminating industrial waste water. In operation at the enterprise is a four-stage purification system (biological, chemical, neutralization and final purification) which guarantees the complete safety of the animal and plant world of the water basins. [Text] [Moscow EKONOMICHESKAYA GAZETA No 47, Nov 76 p 14] 11052

NATURE CONSERVATION IN MOSCOW OBLAST--Much attention is being devoted to nature conservation and environmental protection in Moscow oblast. Purification facilities are being built in the towns and villages. The area of forest plantings is being expanded. Animal and plant life is being enriched. In Dubna, for example, in order to involve the public in work on these projects, a nature conservation department has been created at the national university in which 400 people are now at work. Two topical lecture series have been organized. Much effort and energy are being devoted to the beautification of the city. Over a thousand trees and 12,000 shrubs have been planted along the streets within the first six months alone. /Text/ /Moscow EKONOMICHESKAYA GAZETA in Russian No 49, Dec 76 p 17/ 8963

CSO: 5000

RADIOACTIVE POLLUTION IN GRENOBLE'S WATER TABLE

Paris LE MONDE in French 2 Dec 76 p 16

[Article by Bernard Elie]

[Text] Grenoble--The water stratum lying under the Centre d'etudes nucleaires de Grenoble (CENG) [Grenoble Nuclear Research Center] and the Institut Laue-Langevin (ILL)[1] is polluted by radioactive substances.

Such are the conclusions of three experts appointed by the examining magistrate following the complaint lodged in November 1975 by two associations--the Association pour la protection de l'environnement de la région grenobloise (APERG) [Association for Environmental Protection of the Grenoble District] and the Mouvement écologique Rhône-Alpes (MERA) [Rhone-Alps Ecological Movement]--against the nuclear laboratories of Grenoble (le Monde of 22 January 1976). The experts state that the increase in radioactivity in the underground stratum at right angles to the laboratories, reached nine times the maximum permissible concentration for the population. However, though exceeding the limit this way seems spectacular, in view of the extremely low threshold fixed by the textbooks, there is no immediate danger. Actually some bottles of mineral water show a radioactivity sometimes two or three times as high as the maximum permissible concentration for the population.

The measurements and analyses carried out by the experts did not permit them 'to reveal any contamination of the stratum' downstream of the laboratories. However these specialists prudently indicate that the measurements were undertaken for a limited time (April 1976) and that 'only a thorough study of the phenomena of propagation and transfer of pollution extending over several hydrological cycles would make it possible to confirm or refute the observations.' In the opinion of Prof Philippe Lebreton, biologist and chairman of MERA, the long-term repercussions are precisely those constituting the most serious danger of radioactive pollution.

1. The ILL is an experimental reactor administered by a French-English-German organization.

The management of CENG does not deny that infiltrations of radioactive effluents, from authorized regulation dumping, may have occurred in the subsoil because of defects in the sewage system.

However, by confirming the disclosures made in 1975 by the Grenoble ecologists, the experts lend weight to their reasoning which is also that of the syndicalists. If all the safety measures in public nuclear laboratories are not followed for want of financial means, the ecologists say, it is doubtful that these measures would be satisfied any better when nuclear activities fall in the hands of private enterprises. Since ecologists consider these facts very serious, during a press conference held at Grenoble on 23 November they demanded the indictment of the Director of the Service central de protection contre les radiations ionisantes (SCPRI) [Central Department for Radiation Protection] and of the head of the CENG Department of Environmental Protection and Studies.

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BRIEFS

ANKARA AIR POLLUTION--The Ankara Chamber of Physicians and the Pharmacists Association has announced that air pollution in Ankara has surpassed the permissible limit by 37 times. According to measurements made on 15 November, the amount of sulphur dioxide in the air of Ankara has reached 2,252 milligrams per cubic meter, whereas the WHO limit has been set out at 60 per cubic meter. The statement further says that this amount of pollution will soon lead to a large number of deaths. [Istanbul CUMHURIYET in Turkish 22 Dec 76 pp 1, 9 NC]

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